

(19) World Intellectual Property Organization  
International Bureau



PCT

(43) International Publication Date  
27 January 2005 (27.01.2005)

(10) International Publication Number  
**WO 2005/007989 A3**

(51) International Patent Classification:  
*E04B 1/98* (2006.01) *E04B 1/12* (2006.01)

(21) International Application Number:  
PCT/US2004/023030

(22) International Filing Date: 19 July 2004 (19.07.2004)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:  
10/625,102 22 July 2003 (22.07.2003) US

(71) Applicant and

(72) Inventor: BUARQUE DE MACEDO, Pedro, M.  
[US/US]; 6100 Highboro Drive, Bethesda, MD 20817  
(US).

(74) Agents: LO CICERO, Anthony, F. et al.; Amster, Roth-  
stein & Ebenstein LLP, 90 Park Avenue, New York, NY  
10016 (US).

(81) Designated States (unless otherwise indicated, for every  
kind of national protection available): AE, AG, AL, AM,

AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN,  
CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI,  
GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE,  
KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD,  
MG, MK, MN, MW, MX, MZ, NA, NI, NO, NZ, OM, PG,  
PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM,  
TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM,  
ZW.

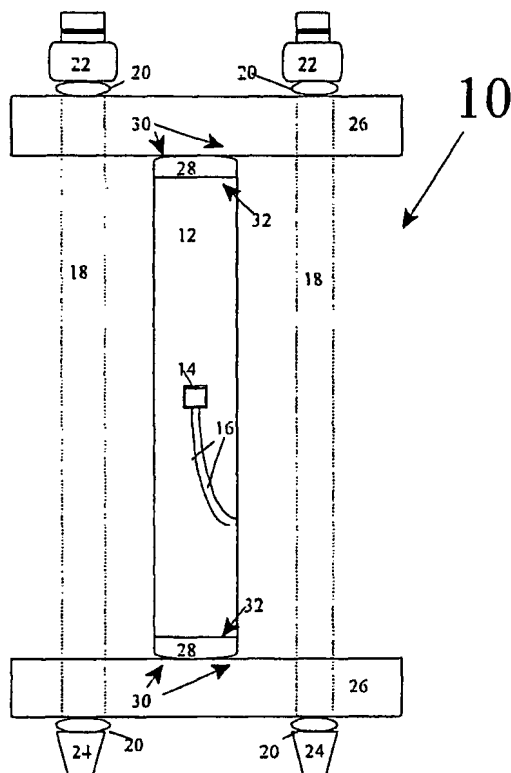
(84) Designated States (unless otherwise indicated, for every  
kind of regional protection available): ARIPO (BW, GH,  
GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM,  
ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM),  
European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI,  
FR, GB, GR, HU, IE, IT, LU, MC, NL, PL, PT, RO, SE,  
SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN,  
GQ, GW, ML, MR, NE, SN, TD, TG).

**Published:**

- with international search report
- before the expiration of the time limit for amending the  
claims and to be republished in the event of receipt of  
amendments

[Continued on next page]

(54) Title: PRESTRESSED, STRONG FOAM GLASS TILES



(57) Abstract: A prestressed, strong foam glass tile for use in construction. The prestressed, strong foam glass tiles of the present invention are capable of withstanding relatively large prestressing as a result of their relatively high compression strength. These prestressed, foam glass tiles will absorb and/or withstand more energy from an explosion, withstand higher heat and wind loading and other mechanical forces than traditional foam glass tiles. The foam glass tile of the present invention is strong enough that it can be prestressed over 1000 psi (1b/sq. in.), and more preferably over 2,000, 3,000, 4,000 and even more preferably over 5,000 psi. The prestressed, strong foam glass tiles of the present invention may be included as part of a prestressed assembly. Said prestressed assembly may be comprised of two metal members, one or more prestressed foam glass tiles, and a tension member such as a tension bolt and/or wires.



(88) Date of publication of the international search report:  
31 August 2006

*For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.*

## INTERNATIONAL SEARCH REPORT

International application No.

PCT/US04/23030

## A. CLASSIFICATION OF SUBJECT MATTER

IPC: E04B 1/98( 2006.01),1/12( 2006.01)

USPC: 52/223.5,223.7

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 52/223.5, 223.7, 223.4, 223.6, 223.9, 223.14, 23, 284

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)  
EAST text search in class 52, 264, and

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 4,324,037 A (GRADY, II) 13 April 1982 (13.04.1982), Figs. 2, 3, and 7.	1-12, 23-32, 36, and 37
Y	US 3,430,397 A (ELLIS) 04 March 1969 (04.03.1969), Figs. 1 and 2.	1-5, 13-21, 23-27, 29-31, 34, 35, and 37
Y	US 4,450,656 A (LAGENDIJK) 29 May 1984 (29.05.1984), Figs. 2, 5, and 6.	1-7, 12, 23-31, and 36
Y	US 3,292,316 (ZEINETZ) 20 December 1966 (20.12.1966), Figs. 9 and 11.	1-7, 12, 23-31, and 36
Y	US 4,124,365 (WILLIAMS et al.) 07 November 1978 (07.11.1978), col. 1, lines 35-45.	1-7, 12, 23-31, and 36
Y	US 3,986,311 (MUHE et al.) 19 October 1976 (19.10.1976), Figs. 1 and 3.	10, 11, 17, 18, 34, 35, and 37
Y	US 4,694,622 (RICHARD) 22 September 1987 (22.09.1987), Figs. 1 and 6 and col. 2, lines 54-56.	1-6, 12, 16, 23-31, and 36

☒ Further documents are listed in the continuation of Box C.☐ See patent family annex.

\* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T"

later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X"

document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y"

document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&amp;"

document member of the same patent family

Date of the actual completion of the international search

14 May 2006 (14.05.2006)

Date of mailing of the international search report

27 JUN 2006

Name and mailing address of the ISA/US

Mail Stop PCT, Attn: ISA/US  
Commissioner for Patents  
P.O. Box 1450  
Alexandria, Virginia 22313-1450

Facsimile No. (571) 273-3201

Authorized officer

M. Safavi

Telephone No. (571) 272-3600

# INTERNATIONAL SEARCH REPORT

International application No.  
PCT/US04/23030

## C. (Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 5,809,713 (RAY) 22 September 1998 (22.09.1998), Figs. 1, 2, 4, 5, and 9-13 and col. 2, lines 27-28.	15 and 19
Y	US 2,466, 613 (RICHARDSON) 05 April 1949 (05.04.1949), Fig. 1.	7
A	US 3,537,220 (ELLIS) 03 November 1970 (03.11.1970), Figs 2-4.	1-41
A	US 4,875,314 (BOILEN) 24 October 1989 (24.10.1989), Figs. 2-9	1-41
A	US 4,953,332 (GALLOWAY) 04 September 1990 (04.09.1990), Figs. 1-3.	1-41
A	US 6,082,063 (SHRIVE et al.) 04 July 2000 (04.07.2000), Figs. 1 and 10-14 and col. 2.	1-41

# INTERNATIONAL SEARCH REPORT

International application No.

PCT/US04/23030

## Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:  
because they relate to subject matter not required to be searched by this Authority, namely:
  
2. ☐ Claims Nos.:  
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
  
3. ☐ Claims Nos.:  
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

## Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:  
Please See Continuation Sheet

1. ☒ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of any additional fees.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
  
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

- Remark on Protest**
- ☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
  - ☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
  - ☒ No protest accompanied the payment of additional search fees.

## INTERNATIONAL SEARCH REPORT

International application No.  
PCT/US04/23030

### BOX III. OBSERVATIONS WHERE UNITY OF INVENTION IS LACKING

This application contains claims directed to more than one species of the invention. These species are deemed to lack unity of invention because they are not so linked as to form a single general inventive concept under PCT Rule 13.1.

The species are as follows:

Species I - Figure 1;  
Species II - Figure 2;  
Species III - Figures 3A and 3B;  
Species IV - Figures 4A and 4B;  
Species V - Figures 5A and 5B; and  
Species VI - Figure 6.

The claims are deemed to correspond to the species listed above in the following manner:

Species I - Figure 1: claims 1-5, 13-27, and 29-39.  
Species II - Figure 2: claims 1-5, 13-27, and 29-39.  
Species III - Figures 3A and 3B: claims 1-12, 23-36, and 38.  
Species IV - Figures 4A and 4B: claims 1-5, 13-27, 29-38, and 40.  
Species V - Figures 5A and 5B: claims 1-5, 13-27, 29-38, and 40.  
Species VI - Figure 6: claims 1-12, 23-36, 38, 39, and 41.

The following claims are generic: claims 1-5, 23-27, and 29-38.

Regardless of Species I, Species II, Species III, Species IV, Species V, or Species VI, this application contains claims directed to more than one species of the invention with regard to the following tensioning members:

- (1) tension bolt(s): claims 7, 14, and 31.
- (2) wire(s): claims 8, 15, and 32.
- (3) carbon fiber(s): claims 9, 16, and 33.
- (4) seven-wire prestressing strand(s): claims 10, 11, 17, 18, 34, and 35.
- (5) rod(s)/bar(s): claims 12, 19, 22, and 36.
- (6) angle iron(s): claims 20.
- (7) plate(s): claims 21.